SECTION 3

QUESTION 2: Based upon the technical judgment of the peer review panel: A) Are the modeling approaches suitable for representing the relevant external force functions (e.g., hydraulic flows, solids and PCB loads, initial sediment conditions, etc.), describing quantitative relationships among those functions, and developing quantitative relationships between those functions and PCB concentrations in environmental media (e.g., water column, sediments, fish, and other biota, etc.)? B) Are the models adequate for describing the interactions between the floodplains and the River? C) Are the models adequate for describing the impacts of rare flood events? D) Are the models adequate for discriminating between water-related and sediment-related sources of PCBs to fish and other biota?

3.1 EXTERNAL FORCING FUNCTIONS

The approach proposed in the MFD to specify the relevant external forcing functions for the models are generally adequate for this study. Watershed simulations, using HSPF, will be driven primarily by meteorological inputs. Output from HSPF, *i.e.,* tributary discharge and sediment loads, will be transferred to both EFDC and AQUATOX, where it will be used as external forcing (*i.e.,* model) input. A variety of external inputs will be specified for use in EFDC's hydrodynamic, sediment transport and abiotic PCB transport calculations (*e.g.,* bathymetry data and sediment bed properties). Similar to HSPF linkages, output from EFDC will be transferred to AQUATOX and used to specify sediment resuspension and deposition fluxes, horizontal and vertical dispersion, flow between segments, and other transport processes.

Generally, the linkages between the HSPF and EFDC are adequate. However, a number of potential problems exist with the linkages between HSPF and AQUATOX and between EFDC and AQUATOX. A complex procedure for translation of the differing characterizations of solids among the models is discussed in the MFD (pages 4-59 to 4-60). Three sediment-size classes, representing cohesive and non-cohesive sediment, are simulated in EFDC. Information on the transport of these three size-classes is transferred to AQUATOX after processing of the information to translate the size characterization of solids into the organic/inorganic characterization required by AQUATOX. Similarly, HSPF output is processed to provide linkage information on suspended organic matter for input to AQUATOX. The potential exists for an imbalance in organic and inorganic solids between the models because of this complex linkage. Moreover, temporal and spatial collapsing of EFDC results for use in AQUATOX may be problematic. EFDC will include floodplain effects, while AQUATOX neglects the floodplains, and this inconsistency in the numerical grid domain may cause significant errors in AQUATOX results. In Woods Pond, the three-dimensional results from EFDC, which will use 3 to 7 vertical layers, will be collapsed vertically to produce input for the two-layer AQUATOX model (*i.e.,* epilimnion and hypolimnion layers). This type of vertical collapse could be extremely difficult to do correctly because of spatial and temporal variations of the EFDC-predicted thermocline.

Modeling PCB fate with separate models does not add sufficient value to the modeling effort to justify the added complexity in model linkages and, consequently, the uncertainty in model calibration and projections. The USEPA should consider conducting PCB fate calculations only within the EFDC model framework. EFDC has the capabilities of simulating not only PCB fate, but also phytoplankton dynamics. Hence, EFDC can simulate the impacts of phytoplankton on PCB fate. Conducting PCB fate within a single modeling framework will minimize the model coupling problems described above and better ensure that solids and PCB mass continuity are maintained during both the model calibration and projection periods. AQUATOX could then be used to simulate bioaccumulation in invertebrates and fish and would simply require results of EFDC sediment and water column PCB calculations. This type of coupling has been successfully applied by the USEPA and others in a number of systems, including the Fox River/Green Bay and Hudson River (Bierman *et al.,* 1992; Connolly *et al.,* 1992; DePinto *et al.,* 1993; HydroQual, 1995; TAMS *et al.,* 2000; QEA, 1999).

3.2 INTERACTIONS BETWEEN FLOODPLAINS AND RIVER CHANNEL

The ability to model interactions between the channel and floodplain is highly dependent on the numerical grid used in EFDC. The grid to be used in the Riverine/Floodplain (R/FP) model is not specified in the MFD. According to the MFD (page 4-43), three different types of numerical grids will be evaluated using data collected from the test reach, which is located a short distance upstream of New Lenox Road Bridge. These tests will be used to determine the "optimal" grid for the R/FP model. While this approach appears logical and reasonable, the tests, and the associated design of an optimal grid, may focus too heavily on relatively fine-scale hydrodynamic and sediment transport processes that may not be significant at the scale at which PCB fate and transport must be represented in the channel and floodplains. The numerical grid design should focus on: 1) ensuring that the grid resolution is commensurate with available data for the entire R/FP domain, not just the test reach, and 2) the scale of the sediment management questions being addressed by the model.

PCB fluxes between the channel and floodplain will be calculated in EFDC and transferred to AQUATOX via model linkages. Differences between the within-channel PCB concentrations calculated by AQUATOX and EFDC may create PCB continuity problems as the EFDC channel-floodplain fluxes are passed to AQUATOX. For example, if, for a period of floodplain inundation, the within-channel water column PCB concentrations calculated by EFDC are higher than those calculated by AQUATOX, then the floodplain PCB fluxes passed from EFDC to AQUATOX would over-estimate the flux of PCBs to the floodplain with respect to the AQUATOX simulation. In the extreme case, the EFDC-calculated PCB fluxes could exceed the mass of PCBs within an AQUATOX segment and result in negative PCB calculations. Again, to avoid this continuity problem, the USEPA should consider conducting PCB fate calculations using the EFDC model only. If it does not do so, however, then, at a minimum, procedures should be developed to ensure the maintenance of PCB continuity between EFDC and AQUATOX.

3.3 IMPACTS OF RARE FLOOD EVENT

Predicting the impacts of a rare flood in the Housatonic River is dependent on the numerical grid used for the hydrodynamic and sediment transport models. The MFD does not specify what type of numerical grid, or the associated resolution, will be used in the R/FP model. Therefore, it is difficult to determine whether or not the model will be adequate for simulating a rare flood.

The MFD states (page 3-49) that floodplain soils may be resuspended during large flood events and transported to the River channel. No evidence of this phenomenon is presented in the MFD. In addition, methods to model floodplain soil erosion are not discussed. This process could be quite complicated and site-specific data would be needed to provide model parameters for soil erosion.

3.4 WATER-RELATED AND SEDIMENT-RELATED SOURCES OF PCBS TO BIOTA

As described in Section 2.5 above, the structure of the food web used to describe PCB bioaccumulation will be sensitive to the results of the biomass calculations, which in turn are relatively unconstrained by site-specific data. This means that AQUATOX may not discriminate appropriately between sediment and water-related sources of PCBs to biota. Specifically, the relative importance of sediment and water column-based PCBs to the food web may bear little relation to the feeding preferences as entered into the model, because of biomass dynamics. To the extent that sufficient biomass remains in the system to permit each species to consume prey according to that species' preferences, as specified by the user, the biomass predictions provide no added value. To the extent that the biomass calculations modify those inputs, they do so with no indication of the realism of the modification.

For these reasons, the USEPA should not use the biomass calculations in computing feeding preferences. Rather, as discussed in Section 2.5, feeding preferences should be input by the user, based on site data and published studies of the modeled species in similar water bodies. Uncertainty in the food web structure should then be explored in sensitivity and uncertainty analyses.